

1. Ecosystems and Soils

On the 3000 mile flight from New York to San Francisco the plane traverses a landscape of gigantic proportions. The rugged mountains, smooth hills, rolling plains, broad valleys, rivers, and lakes are *ecosystems* with wide variations in climate, bodies of water, soils, vegetation, animal life, and human activities. This book brings into focus the soil resource, its creation by nature, its variation over continents, and its husbandry by man.

A. Concept of Ecosystem

In 1935 the botanist Tansley defined the ecosystem as the aggregate of plants, animals, and microbes *plus* the environment in which they live. The term has gained great popularity. *Eco* reminds one of ecology, the study of the relations of organisms to their environment; and *system* is the magic word of the exact sciences.

The Finite Ecosystem

The entire Earth may be considered one giant ecosystem that extends outward to infinity. It is overwhelmingly complex. A convenient small segment, a piece of landscape with arbitrary boundaries, is sketched in Figure 1.1. The boundaries create a *finite* physical system that has finite volume and mass and permits evaluation of energy and mass flow across the imposed boundaries. System boundaries may be placed anywhere: around a watershed, a forest, a pond, a soil, or an organism. Always, the system is what is inside the boundaries; on the outside is the surroundings or environment. Ecosystem and surroundings together constitute the ecosystem universe. The distinctions are important for system analysis. Whereas the finite ecosystem becomes organized and ordered, the ecosystem universe always gains disorder or entropy.

The Land Ecosystem

When, as in Figure 1.1, soil is inside the chosen boundaries, the entire soil-plant body is termed "larger system" (6), terrestrial ecosystem, or land ecosystem. Terrestrial ecosystems are contrasted with aquatic ecosystems: rivers, ponds, lakes, and oceans. At